

AN ECOLOGICAL SURVEY OF A PROPOSED
T. MOUNT EDDY RESEARCH NATURAL AREA

by

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PSW FOREST AND RANGE
EXPERIMENT STATION

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The proposed Mt. Eddy Research Natural Area contains extensive Pinus balfouriana forests and a number of rare and endangered plants. It is suggested in this survey that the area include the summit of Mt. Eddy and its west and south facing slopes to the southern edge of Lower Deadfall Lake. This area lies roughly within the northern half of Section 24, T. 40 N., R. 6 W., M.D.M. of the China Mountain Quadrangle and slightly more than the northwestern quarter of Section 18, T. 40 N., R. 5 W., M.D.M. of the Weed Quadrangle (Figure 1). The ridge running toward the northwest corner of Section 24 from a high point just below the center of Section 24 forms a natural southwest border for the proposed area. From the same high point, a line may be extended due east to an eastern boundary on the east side of the North-South ridge in Section 18. These lines outline the southern and eastern borders. The northern borders are the northern demarcations of Section 24 and Section 18.

Topographically, the area includes a ridge extending south from Mt. Eddy, another ridge extending southwest, and a lower ridge to the south of the Deadfall Lakes. The area consists of mainly west and south facing-slopes, varying from

20% to 50%. Elevation extends from 7200 ft. at the southern edge of Lower Deadfall Lake to the summit of Mt. Eddy at 9,025 ft.

Geologically, Mt. Eddy is part of the Trinity pluton which is a sheet of ultramafic rock associated with the eastern belt of the Klamath Mountains. The primary parent rock within the proposed area is peridotite in varying degrees of serpentinization. Along the western boundary, there is a granite intrusion. There is extensive evidence of Pleistocene glaciation within the proposed area, especially in the Deadfall Lakes drainage. Throughout the region, there is much exposed rock (50-75%). Soils are thin, gravelly, and unstable.

The climate is typical of the eastern Klamath Region. The bulk of the precipitation occurs in the winter months, but occasional summer thunderstorms also contribute to the annual precipitation. The Mt. Shasta Weather Bureau Station at 3544 feet, approximately 9 miles east shows a mean annual precipitation of 36.72 inches. On Mt. Eddy, the Deadfall Lakes Snow Course average April 1 depth of snow is 82.7 inches, with an average water content of 33 inches. Therefore, it is possible that precipitation totals on the mountain are fairly similar to Mt. Shasta City. The mean daily temperatures range from 33.3°F. in January to 68.0°F. during the warmest month of July in Mt. Shasta City. It is obvious that temperatures 3500 to 5500 feet higher on Mt. Eddy would be correspondingly

cooler. There is normally no permanent snow on Mt. Eddy despite its stature as the highest peak in the Klamath Mountains.

The vegetation of the area is primarily composed of high elevation open pine forests with sparse rocky slope herbs and a noticeable lack of shrub understory. The most extensive vegetation is a Pinus monticola-dominated forest. Within this forest are several meadows and streamsides which contain a rich mix of herbs including Darlingtonia californica. On a portion of the north-facing slope above Deadfall Lake occurs vegetation dominated by Artemisia tridentata. This is not extensive, but is of interest because of the Great Basin aspect. Above the Pinus monticola forests a nearly pure P. balfouriana forest exists. At still higher elevations on rocky slopes and ridges, the vegetation consists largely of herbs with a few scattered individuals of P. albicaulis and P. balfouriana.

Interesting endemic and sensitive plants can be found in much of the area. Darlingtonia californica has already been mentioned. Plants of the species at 7400 feet may be the highest known populations in existence. Veronica copelandii, Eriogonum alpinum, Eriogonum siskiyouense, Draba aureola, Cryptantha subretusa, Campanula scabrella, and Thelypodium brachycarpum are sensitive plants occurring in the proposed Research Natural Area.

MATERIALS AND METHODS

An inventory of the vascular plants of the Mt. Eddy area

was begun in June 1976, and repeated trips and collections were made each summer until the present (Whipple, 1979). Voucher specimens of all species are filed in the Humboldt State University Herbarium (HSC). In middle July, 1978, an ecological survey was conducted to quantify parameters of the vegetation.

A general reconnaissance suggested mixed pine forest, Pinus balfouriana forest and rocky slope herbs as possible vegetation entities. To sample canopy, understory and ground layers 79 relevés were taken. Standard techniques (Mueller-Dombois and Ellenberg, 1974) were used to determine species coverage. Association tables were produced to determine differences in species composition among vegetation types and their phases.

Basal area and density of the two forest types were determined separately by the belt-transect method (Mueller-Dombois and Ellenberg, 1974). A tenth acre plot was taken from every other interval of 100 feet as measured by tape. Trees over 4 inches in diameter were taped at breast height. A total of 36 tenth acre plots were taken for the two forest types. Ten healthy individuals of each dominant tree, Pinus monticola and P. balfouriana, of varying sizes were cored and rings counted. The heights were determined for each of the sampled individuals. The ages were plotted against the heights of each of these trees to derive growth rates.

RESULTS

In the proposed area 289 taxa have been identified. Of these, Campanula scabrella, Draba aureola, Cryptantha subretusa, Eriogonum alpinum, Eriogonum siskiyouense, Thelypodium brachycarpum, and Veronica copelandii are considered very rare or rare and endangered by the California Native Plant Society (CNPS Special Publication #1, 1974). Also, Mt. Eddy is sited as the type locality for several taxa occurring within the area including Carex gigas, Orthocarpus copelandii, Veronica copelandii, Astragalus whitneyi ssp. siskiyouensis, Mimulus primuloides ssp. linearifolius, and Rudbeckia californica var. intermedia. Since early citations were often quite poor, it is possible that Mt. Eddy is the type locality of several other species. For example, the location of the original collection of Pinus balfouriana is interpreted to be the Scott Mountains, which by many authors has included Mt. Eddy.

The 40 relevés of the two forest types and the 39 relevés of the rocky slope herb type were grouped into association tables from which a presence table (Table 1) yielded three major categories. A Pinus monticola/Angelica arguta type and a Pinus balfouriana/Anemone drummondii type are proposed as the two kinds of forest. An herb type, Penstemon procerus/Potentilla glandulosa, is observed to have two phases, one characterized by Eriogonum siskiyouense and the other by Lesquerella occidentalis.

The Pinus monticola/Angelica arguta type begins at the

westernmost boundary and lowest elevations (7200 feet) of the proposed area. This is an open forest primarily composed of Pinus monticola with an average canopy total cover of 20%. Abies concolor is an important component (up to 20% of the canopy) here and is also relatively abundant at lake margins or streamsides throughout the type. Pinus albicaulis is frequently an important canopy species. This is particularly true at the upper elevational limits. Typically, the understory covers no more than 15%, and consists of Arctostaphylos nevadensis and Quercus vaccinifolia. On more xeric and higher south-facing slopes the understory can reach 65% cover.

The meadows, streamsides, and lake margins occur in the Pinus monticola/Angelica arguta type. Dodecatheon alpinum, Caltha howelli, Helenium bigelovii, Darlingtonia californica, and several Carex and Eleocharis species dominate the meadows. The streamsides and lake margins also include these species in abundance, and frequently Potentilla fruticosa and Pinus contorta ssp. murrayana. Around the northwest and western edges of Deadfall Lake, some large specimens of Cercocarpus ledifolius occur. On the north-facing slope above Deadfall Lake, there is an area of Artemisia tridentata, Lonicera conjugialis, Lupinus croceus, and Bromus marginatus-dominated vegetation.

Sensitive species that occur in the Pinus monticola/Angelica arguta type are Thelypodium brachycarpum which is rare in the open woods and dry meadow edges, and Veronica copelandii

which is common near upper elevation seeps and streamsides.

At 7800 to 8000 feet, the Pinus balfouriana/Anemone drummondii type becomes developed. This is another open forest type with the average total canopy cover 18%. Pinus balfouriana was the only tree species present in 50% of the relevés and the major canopy component in all the relevés. Shrub understory cover can be considerable (25% cover) at lower elevations, but usually is absent. P. albicaulis is only occasional and partially replaced by P. monticola at lower elevations. Anemone drummondii is nearly always present (Table 1) and typically exceeds 10% cover. On the eastern slopes of the ridge extending south from Mt. Eddy this forest is more open.

The Penstemon procerus/Potentilla glandulosa type is realized on the ridge south of Deadfall Lake, the summit of Mt. Eddy, the ridges extending to the east and south from Mt. Eddy and the higher southern and eastern slopes of the later ridges. At the higher elevations (8500-9000 feet) and southwest slopes the Lesquerella occidentalis phase is observed. The Eriogonum siskiyouense phase is recognized at 7900-8100 feet on the southern slopes of the ridge above Deadfall Lake. This phase contains more Crepis pleurocarpa (93% versus 25% presence), Phlox diffusa (73% versus 29% presence), Sedum lanceolatum (80% versus 0% presence), Arenaria congesta (67% versus 0% presence), and Eriogonum siskiyouense (67% versus 0% presence); and less Poa pringlei (33% versus 79% presence) and Lesquerella occidentalis (20% versus 67% presence) than the Lesquerella occidentalis phase. There is no Erigeron compositus, Hulsea nana, and Ivesia gordonii in the Eriogonum siskiyouense phase.

Potentilla fruticosa is the only shrub commonly found in this type, but occurs rarely in the Eriogonum siskiyouense phase. Occasional stunted Pinus albicaulis and, rarely, P. balfouriana can be found throughout this type. Eriogonum umbellatum and Sitanion hystrix are other important herb species in this vegetation type, which covers about 25% of the loose gravel substrate.

There are several sensitive plants occurring in the Penstemon procerus/Potentilla glandulosa type. Cryptantha subretusa and Campanula scabrella are occasionally present from 8000 to 9000 feet on loose soil or gravel on the south and west slopes of Mt. Eddy. Eriogonum siskiyouense is present occasionally on rocky slopes at lower elevations within the type. All three taxa have healthy, adequate populations present within the proposed area. Eriogonum alpinum is rare on very loose soil on the upper slopes of Mt. Eddy. Because of the nature of the preferred substrate, this taxa is quite sensitive to disturbance. Draba aureola is quite rare on Mt. Eddy, being previously reported only on Mt. Lassen in California. This Draba occurs in the summit area of Mt. Eddy on the north and west-facing slopes at the extreme northern edge of the proposed area.

The total acreage of the proposed Research Natural Area is approximately 940 acres. It is estimated that the Pinus monticola/Angelica arguta type comprises about half of the area (480 acres), the Pinus balfouriana/Anemone drummondii type covers roughly one fourth of the area (240 acres), and the Penstemon procerus/Potentilla glandulosa type and bare rock complete the acreage.

Basal area and density for the two forest types are determined by the belt-transect method. The Pinus monticola/Angelica arguta type has a total density of 44 trees acre⁻¹ and a total basal area of 138.7 ft²acre⁻¹. Approximately 15% of the trees in the plots were species other than P. monticola. In contrast all but three trees in the Pinus balfouriana/Anemone drummondii plots were P. balfouriana. The total basal area and density of this type was 184.7 ft²acre⁻¹ and 44 trees acre⁻¹, respectively.

The growth curves (Figures 3, 4) were derived from counting the rings of core samples from healthy canopy trees of Pinus monticola and P. balfouriana of various sizes and plotting this data against heights of the trees.

SUMMARY

The Mt. Eddy Research Natural Area, as proposed here, can be divided into three elevationally separated vegetation types. At 7900 feet and above, a Penstemon procerus/Potentilla glandulosa type occurs with two phases, Lesquerella occidentalis and Eriogonum siskiyouense. A Pinus balfouriana/Anemone drummondii type occurs below this and grades into a Pinus monticola/Angelica arguta type. Within the later type, there are anomalous groupings. Artemisia tridentata dominated vegetation and several Cercocarpus ledifolius individuals exist near Deadfall Lake. Meadows, moist stream and lake sides support a rich herb mix, but it is not extensive. Darlingtonia

californica reaches its probable highest elevation at approximately 7400 feet in this type. Several sensitive species including Campanula scabrella, Cryptantha subretusa, Draba aureola, Eriogonum alpinum, Eriogonum siskiyouense, Thelypodium brachycarpum, and Veronica copelandii are represented in the area.

EVALUATION

An extensive, nearly pure Pinus balfouriana forest highlights the vegetation of the proposed area. The forest has great research value as a large, typical, and healthy example of northern Pinus balfouriana. The parent materials present in the area create an example of high elevation eastern Klamath Region ultramafic plant associations. The proposed area is also of interest due to the presence of at least seven sensitive species. Of these, five are well represented and two, Thelypodium brachycarpum and Draba aureola are present within the boundaries but rare. Darlingtonia californica occurs at a very high elevation.

Unfortunately, the area receives recreational use. The Pinus monticola/Angelica arguta forest, and, particularly its meadows, and lake and streamsides are under heavy impact. The area is less than two miles by foot from the road. The Pinus balfouriana stands, however, receive very little impact though the summit trail does pass through them. Since there is a spectacular view of Mt. Shasta from the summit, this trail will continue to be used. At this time, the recreational use would not have a detrimental effect on research in the area.

This accessibility, though, to Mt. Eddy insures easy approach for researchers to the proposed area. There is a good trail from the road (42N17) all the way to the summit of the mountain. Therefore, there is unusually easy access to a subalpine habitat.

Already, Mt. Eddy is being utilized for research. There is a floristic study in progress (Whipple, 1979). Also, there are geological and rodent studies ongoing in the vicinity by individuals from California State University at Los Angeles.

The southern boundaries of the proposed research natural area are chosen to conform as far as possible with natural features such as the ridge in section 24. The southern border in section 18 is a steep slope with little merit to be derived from further extending the boundary to the south. The boundary could be extended to the east, though the major extent of the Pinus balfouriana forest and three populations of the very rare Eriogonum alpinum are included within the presented boundaries. Further expansion eastward to the southeast facing slopes of northeast section 18 and northwest section 17 would allow the inclusion of a population of Lupinus lapidicola, a rare plant whose type locality is Mt. Eddy.

It is unfortunate that neighboring sections 13 and 7 to the north are privately owned. The southeast running ridge crest to Mt. Eddy in these sections would create a natural northern boundary. In contrast, the present boundary is highly

artificial within the area of the Deadfall Lakes. The acquisition of the land by the United States Forest Service would create a logical natural boundary to the proposed area.

A portion of section 14 was not included within the boundaries as presented since it was isolated from the rest of the proposed area due to private ownership of section 13. If the recommended portion of section 13 was acquired, the addition of an area north of the ridge in section 14 would be valid. This region contains more extensive, lower elevation meadows and bogs in a primarily Abies concolor forest. There are occasional large, mature individuals of Pinus jeffreyi. The major portion of the highest elevation populations on Mt. Eddy of Darlingtonia californica occur in sections 13 and 14.

The high elevation northern slopes of Mt. Eddy would also be a valuable expansion. There are additional populations of Draba aureola, and Eriogonum alpinum on extremely loose, unstable gravel on the north slope of Mt. Eddy above 7600 feet in the southwest portion of section 7. These two taxa are extremely sensitive to disturbance due to the nature of this substrate.

Mt. Eddy, even without additions to the proposed Research Natural Area would provide an excellent example of northern Pinus balfouriana forest. The population is large, healthy, and would be an ideal research tool for comparisons to the southern populations. The area is also of value since it includes representative samples of high elevation vegetation on ultramafic parent rock of the eastern Klamath Mountains. Significantly, the proposed area is highly accessible.

LITERATURE CITED

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. Wiley, New York. 547 p.

Powell, W. Robert (ed.). 1974. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society Special Publication No. 1. 56 p.

Whipple, J.J. 1979. A Flora of Mt. Eddy. Humboldt State University M.A. Thesis. (in process)

Table 1. Presence (P%) and modal cover/abundance (C/A) for all sampled shrubs, and for herbs with >10% presence. Pinus monticola/Angelica arguta type and Pinus balfouriana/Anemone drummondii type sampled with 20 relevés each, and Penstemon procerus/Potentilla glandulosa type with 39 relevés (Eriogonum siskiyouense phase with 15 and Lesquerella occidentalis phase with 24). Cover/abundance scale: 1=one individual, 2=rare and <10%, 3=common and <10%, 4=10-25%, 5=25-50%, 6=50-75%, 7=75%. Applicable subspecific nomenclature in Appendix 1.

Type Phase	Pinus/Angelica		Pinus/Anemone		Penstemon/Potentilla			
	%P	C/A	%P	C/A	Eriogonum		Lesquerella	
<u>Trees, Upper Canopy</u>								
Pinus monticola	100	4	25	3				
Abies concolor	55	2						
Pinus balfouriana	45	2	100	4	7	2		
Pinus albicaulis	40	2	45	2	20	2	13	2
Abies magnifica	35	2						
Pinus Jeffreyi	5	1						
<u>Trees, Lower Canopy</u>								
Pinus monticola	90	3	30	2				
Abies concolor	70	2	20	1				
Pinus balfouriana	20	2	100	3	20	1	8	1
Pinus albicaulis	35	2	60	2			30	2
Abies magnifica	20	2						
Pinus Jeffreyi	5	1			7	1		
<u>Shrubs</u>								
Arctostaphylos nevadensis	55	4	30	4				
Quercus vaccinifolia	50	3	15	2				
Ribes montigenum	10	2						
Holodiscus microphyllus	10	2			7	1		

Type Phase <u>Shrubs, (continued)</u>	Pinus/Angelica		Pinus/Anemone		Penstemon/Potentilla			
	%P	C/A	%P	C/A	Eriogonum		Lesquerella	
					%P	C/A	%P	C/A
Chrysothamnus nauseosus					13	2		
Potentilla fruticosa					7	2	42	3

<u>Herbs</u>								
Anemone drummondii	75	3	90	4	7	2	4	2
Crepis pleurocarpa	65	2	10	2	93	2	25	2
Phlox diffusa	55	2	70	3	73	2	29	2
Achillea lanulosa	55	2	65	2	47	2	21	2
Sitanion hystrix	50	2	45	2	60	2	54	2
Galium glabrescens	40	2	35	2	20	2	8	2
Eriogonum umbellatum	40	2	50	2	67	2	58	2
Astragalus whitneyi	30	2	60	2	40	2	33	2
Poa pringlei	15	2	80	2	33	2	79	2
Castilleja arachnoidea	30	2	35	2	47	2	4	2
Thlaspi fendleri	25	2	30	2	33	2	25	2
Festuca idahoensis	10	2	25	2	67	4	25	3
Carex multicaulis	10	2	15	2	7	2	8	2
Linum perenne	5	2	10	2	7	2	4	2
Arenaria nuttallii	65	2	60	2			8	2
Erysimum perenne	50	2	60	2			17	2
Sedum lanceolatum	25	2	5	2	80	2		
Arabis suffrutescens	25	2	40	2			15	2
Arenaria congesta	15	2	15	2	67	2		
Castilleja applegatei	15	2	5	2	7	2		
Lomatium engelmannii	15	2	5	2	27	2		

Type Phase <u>Herbs, (continued)</u>	Pinus/Angelica		Pinus/Anemone		Penstemon/Potentilla			
					Eriogonum		Lesquerella	
	%P	C/A	%P	C/A	%P	C/A	%P	C/A
Viola purpurea	5	2	40	2			4	2
Polystichum lemmonii	10	2	30	2			8	2
Cirsium drummondii	10	2	15	2			29	2
Cryptantha subretusa	10	2			33	2	46	2
Leptodactylon pungens	5	2			33	2	21	2
Silene grayi	5	2			47	2	4	2
Angelica breweri	80	2						
Bromus marginatus	40	2						
Phacelia mutabilis	20	2						
Allium campanulatum	15	2						
Poa nervosa	15	2						
Penstemon parvulus	10	2						
Lupinus croceus	10	2						
Polygonum davisiae	70	2	70	2				
Hydrophyllum occidentale	65	2	20	2				
Monardella odoratissima	60	2	20	2				
Senecio integerrimus	50	2	30	2				
Haplopappus greenei	35	2	20	2				
Cheilanthes gracillima	10	2	45	2				
Phacelia corymbosa			10	2				
Streptanthus barbatus			10	2				
Calyptridium umbellatum			20	2			17	2
Penstemon procerus					73	2	79	3
Potentilla glandulosa					60	2	58	2
Senecio canus					47	2	13	2

Type Phase <u>Herbs, (continued)</u>	Pinus/Angelica		Pinus/Anemone		Penstemon/Potentilla			
	%P	C/A	%P	C/A	Eriogonum		Lesquerella	
					%P	C/A	%P	C/A
Campanula scabrella					27	2	42	2
Lesquerella occidentalis					20	2	67	2
Eriogonum strictum					20	2	17	2
Eriogonum siskiyouense					67	3		
Erigeron tener					27	2		
Erigeron compositus							54	2
Hulsea nana							33	2
Ivesia gordonii							25	2
Phacelia hastata							17	2
Mimulus nanus							13	2

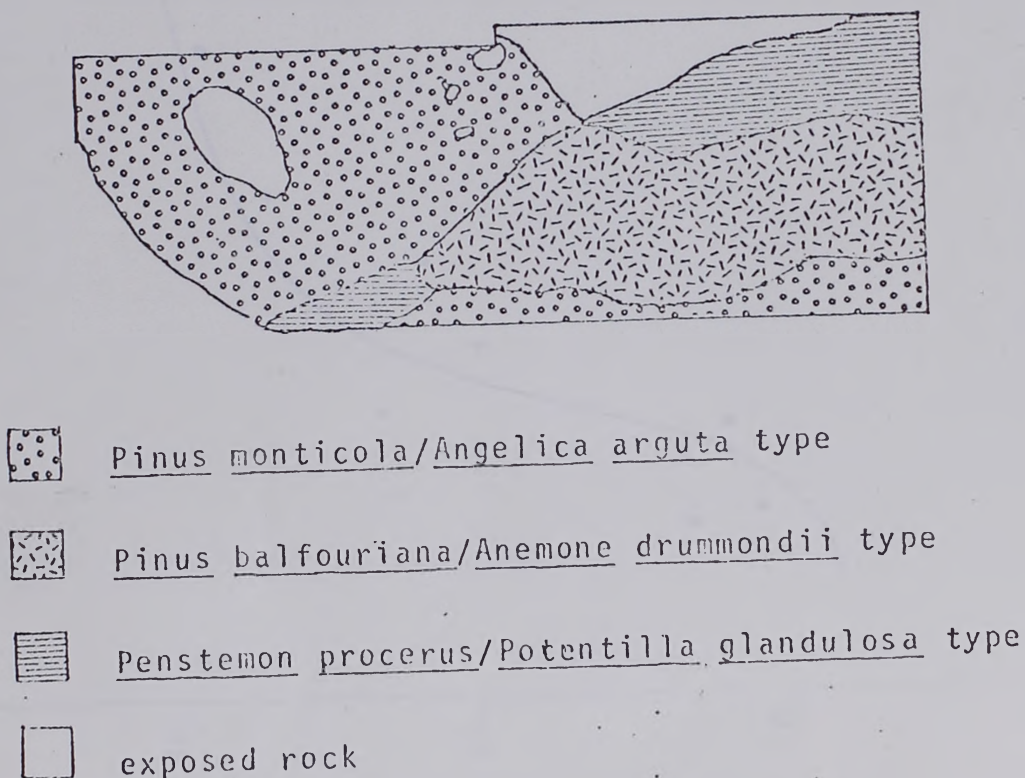
Table 2. Heights (in feet) and ages determined from cores of Pinus monticola and Pinus balfouriana. Trees cored at breast height. (*=minimun age due to inability to count inner rings since the corer was too short.)

tree#	<u>Pinus monticola</u>		<u>Pinus balfouriana</u>	
	age	height	age	height
1	71	15	55	13
2	90	12	59	11
3	99	17	91	12
4	100	21	93	23
5	110	21	113	20
6	143	26	140	22
7	177	26	160	27
8	218	33	196	38
9	286*	66	220	29
10	330*	80	330*	29

Figure 1. Topographic map showing location of the proposed Mt. Eddy Research Natural Area.



Figure 2. Gross vegetation types for the proposed Mt. Eddy Research Natural Area.



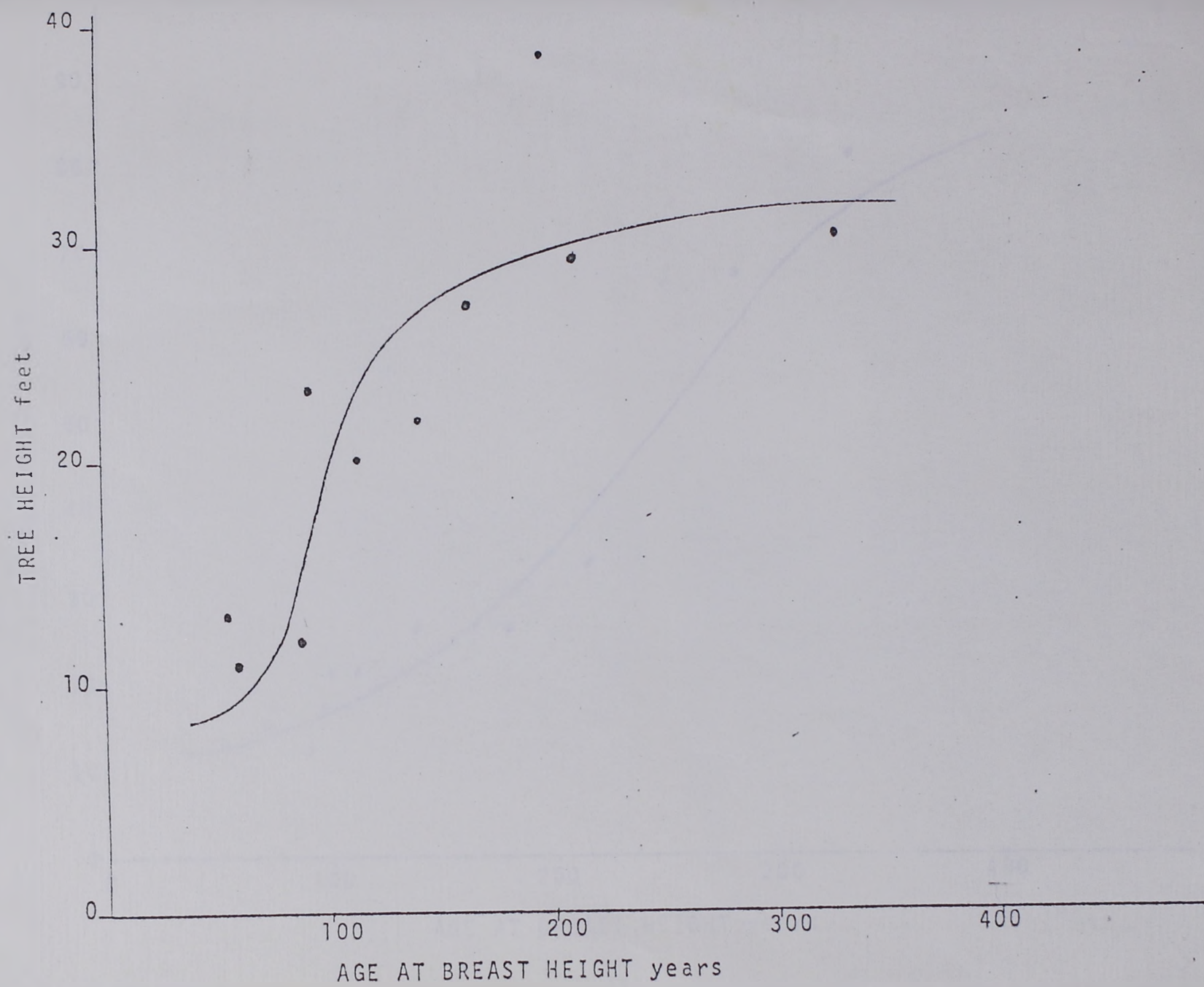


Fig. 5--Pinus balfouriana in
typical Pinus bal fouriana/
Anemone drummondii type
on south slope of Mt. Eddy.



Fig. 6--Open forest in Deadfall
drainage(Pinus monticola/
Angelica arguta type).





Fig. 7--Upper slopes of Mt. Eddy in Penstemon procerus/
Potentilla glandulosa type.



Fig. 8--Closeup of typical Lesquerella phase
of Penstemon procerus/Potentilla
glandulosa type. Species present
include Penstemon procerus, Erigeron
compositus, Senecio canus, and
Eriogonum umbellatum.



Fig. 9--View of Deadfall drainage from summit of Mt. Eddy.
The proposed boundary lies right of center in this view



Fig. 10--High elevation (7200 feet) Darlingtonia californica
population in meadow near Deadfall Lake just outside
the proposed boundary.

APPENDIX 1

Appendix 1. Vascular plants known to occur within the proposed Mt. Eddy Research Natural Area. Collected plants were identified using the facilities of the Humboldt State University Herbarium (HSC). Vouchers are deposited there. Nomenclature mainly follows P. Munz. 1959, A California Flora. University of California Press, Berkeley. 1681 p.

Aspidiaceae

- Cystopteris fragilis (L.) Bernh.
- Polystichum lemmonii Underw.
- Polystichum scopulinum (D.C.Eat.) Maxon.

Boraginaceae

- Cryptantha affinis (Gray) Greene.
- Cryptantha subretusa Jtn.
- Cryptantha torreyana (Gray) Greene.
- Hackelia jessicae (McGreg.) Brand.
- Plagiobothrys hispidulus (Greene) Jtn.

Campanulaceae

- Campanula rotundifolia L.
- Campanula scabrella Engelm.

Caprifoliaceae

- Lonicera conjugialis Kell.
- Symphoricarpos vaccinoides Rydb.

Caryophyllaceae

- Arenaria congesta Nutt. ex T. & G.
- Arenaria jamesiana (Torr.) Skinn.
- Arenaria nuttallii ssp. gregaria (Gray) Macquire
- Cerastium arvense L.
- Sagina saginoides (L.) Karst. var. hesperia Fern.
- Silene grayi Wats.
- Stellaria crispa Cham. & Schlecht.
- Stellaria umbellata Turcz.

Compositae

- Achillea lanulosa Nutt.
Agoseris aurantiaca (Hook.) Greene.
Antennaria dimorpha (Nutt.) T. & G.
Antennaria rosea Greene.
Arnica discoidea Benth. var. alata (Rydb.) Cronq.
Arnica mollis Hook.
Artemisia tridentata Nutt.
Aster alpigenus (T. & G.) Gray. ssp. andersonii (Gray) Onno.
Aster ledophyllus (Gray) Gray.
Aster occidentalis (Nutt.) T. & G.
Aster subspicatus Nees.
Brickellia grandiflora (Hook.) Nutt.
Chaenactis douglasii (Hook.) H. & A.
Chrysothamnus nauseosus (Pall.) Britton. ssp. albicaulis
 (Nutt.) Hall & Clem.
Cirsium cymosum (Greene) J.T. Howell.
Cirsium drummondii T. & G.
Crepis occidentalis Nutt. ssp. pumila (Rydb.) Bab. & Steb.
Crepis pleurocarpa Gray.
Erigeron compositus Pursh. var. glabratus Macoun.
Erigeron inornatus (Gray) Gray. var. viscidulus Gray.
Erigeron tener (Gray) Gray.
Eriophyllum lanatum (Pursh.) Forbes.
Eupatorium occidentale Hook.
Happlopappus greenei Gray.
Happlopappus whitneyi Gray. ssp. discoideus (J.T. Howell) Keck.
Helenium bigelovii Gray.
Helianthella californica Gray.
Hieracium albiflorum Hook.
Hulsea nana Gray.
Machaeranthera shastensis Gray var. eradiata (Gray) Cronq. & Keck.
Madia glomerata Hook.
Rudbeckia californica Gray. var. intermedia Perdue.
Senecio canus Hook.

Compositae (continued)

Senecio fremontii T. & G.Senecio integerrimus Nutt. var. major (Gray) Cron.Senecio triangularis Hook.Solidago multiradiata Ait.Taraxacum officinale Wiggers.Tragopogon dubius Scop.

Crassulaceae

Sedum lanceolatum Torr.Sedum oregonense (Wats.) Peck.

Cruciferae

Arabis divaricata A. Nels.Arabis holboellii Hornem. var. retrofracta (Grah.) Rydb.Arabis puberula Nutt.Arabis suffrutescens Wats.Barbarea orthoceras Ledeb.Dentaria californica Nutt.Descurainia richardsonii (Sweet) O.E. Schulz ssp viscosa (Rydb.) DetlDraba aureola Wats.Draba howellii Wats. var. carnosula (O.E. Schulz) C.L. Hitchc.Draba stenoloba Lebed. var. nana (O.E. Schulz) C.L. Hitchc.Erysimum perenne (Wats. ex Cov.) Abrams.Lesquerella occidentalis Wats.Rorippa curvisiliqua (Hook.) Bessey.Streptanthus barbatus Wats.Thelypodium brachycarpum Torr.Thlaspi fendleri Gray. var. hesperium (Pays) C.L. Hitchc.

Cyperaceae

Carex arthrostachya Olney.Carex aurea Nutt.Carex breweri Boott.Carex gigas (Holm) Muhl.Carex hoodii Boott.Carex jonesii Bailey.Carex luzulaefolia W. Boott.Carex luzulina Olney. var. ablata (Bailey) F.J. Herm.Carex multicaulis Bailey.

Cyperaceae (continued)

Carex scopulorum Holm.Carex subfusca W. Boott.Eleocharis montevidensis Kunth var. decumbens (Clarke) V. Grant.Scirpus congdonii Britton.Scirpus criniger Gray.Scirpus microcarpus Presl.

Ericaceae

Arctostaphylos nevadensis Gray.Cassiope mertensiana (Bong.) G. Don.Phyllodoce empetrifomis (Sm.) D. Don.Vaccinium arbuscula (Gray) Merriam.

Fagaceae

Quercus vaccinifolia Kell.

Fumariaceae

Dicentra pauciflora Wats.

Gentianaceae

Gentiana amarella L.Gentiana calycosa Griseb. in Hook.Gentiana newberryi Gray.

Gramineae

Agropyron spicatum (Pursh) Scribn. & Smith.Agropyron trachycaulum (Link.) Malte.Agrostis exarata Trin.Agrostis thurberiana Hitchc.Bromus carinatus Hook. & Arn.Calamagrostis breweri Thurb.Calamagrostis koelerioides Vasey.Danthonia californica Boland. var. americana (Scribn.) Hitchc.Deschampsia caespitosa (L.) Beauv.Deschampsia elongata (Hook.) Munro ex Benth.Elymus glaucus Buckl.Festuca idahoensis Elmer.Festuca rubra L.Hordeum brachyantherum Nevskii.Melica bulbosa Geyer ex Porter & Coult.Melica fugax Bol.Melica stricta Bol.Melica subulata (Griseb.) Scribn.

Gramineae (continued)

Muhlenbergia andina (Nutt.) Hitchc.Muhlenbergia filiformis (Thurb.) Rydb.Phleum alpinum L.Poa incurva Scribn. & Will.Poa leptocoma Trin.Poa nervosa (Hook.) Vasey.Poa nevadensis Vasey ex Scribn.Poa pratensis L.Poa pringlei Scribn.Sitanion hystrix (Nutt.) J.G. Sm.Stipa occidentalis Thurb.Trisetum spicatum (L.) Richt.

Grossulariaceae

Ribes binominatum Heller.Ribes cereum Dougl.Ribes montigenum McClat.Ribes roezlii Regel. var. cruentum (Greene.) Rehd.

Hydrophyllaceae

Hydrophyllum occidentale (Wats.) Gray.Nemophila pedunculata Dougl. ex Benth.Phacelia corymbosa Jeps.Phacelia hastata Dougl. ex Lehm. ssp. compacta (Brand.) Heckart.Phacelia mutabilis Greene.Phacelia pringlei Gray.

Hypericaceae

Hypericum formosum HBK. var. scouleri (Hook.) Coult.

Iridaceae

Sisyrinchium idahoense Bickn. ?Sisyrinchium elmeri Greene.

Isoetaceae

Isoetes muricata Durieu var. hesperia Reed.

Juncaceae

Juncus balticus Willd.Juncus ensifolius Wikstr.

Juncaceae (continued)

Juncus howellii F.J. Herm.Juncus mertensianus Bong. subsp. gracilis (Engelm.) F.J. Hermann.Juncus mertensianus Bong. ssp. mertensianusLazula comosa E. Mey.

Labiatae

Monardella odoratissima Benth ssp. pallida (Heller) Epl.Prunella vulgaris L. ssp. lanceolata (Barton) Hult.Scutellaria antirrhinoides Benth.Stachys rigida Nutt. ex Benth.

Leguminosae

Astragalus whitneyi Gray. var. siskiyouensis (Rydb.) Barneby.Lupinus croceus Eastw.Lupinus sellulus Kell. ssp. ursinus (Eastw.) Munz.Trifolium cyathiferum Lindl.Trifolium longipes Nutt.

Liliaceae

Allium campanulatum Wats.Allium falcifolium H. & A.Allium validum Wats.Calochortus nudus Wats.Fritillaria atropurpurea Nutt.Lilium kelleyanum Lemmon.Narthecium californicum Baker.Schoenolirion album Durand.Smilacina stellata (L.) Desf.Tofieldia glutinosa (Michx.) Pers. ssp. occidentalis (Wats.) B.S.P.

(Wats.) C.L. Hitchc.

Veratrum californicum Durand.

Limnanthaceae

Floerkea proserpinacoides Willd.

Linaceae

Linum perenne L. ssp. lewisii (Pursh) Hult.

Loasaceae

Mentzelia dispersa Wats.

Loranthaceae

Arceuthobium campylopodum Engelm. in Gray. forma blumeri
(A. Nels.) Gill.

Malvaceae

Sidalcea oregana (Nutt.) Gray. ssp spicata (Regel) C.L. Hitchc.

Onagraceae

Epilobium angustifolium L.

Epilobium halleanum Hausskn.

Epilobium minutum Lindl. ex Hook.

Epilobium obcordatum Gray. ssp siskiyouense Munz.

Epilobium paniculatum Nutt. ex T. & G.

Epilobium pringleanum Hausskn.

Gayophytum diffusum T. & G. ssp. parviflorum Lewis & Szweykowski.

Gayophytum humile Juss.

Orchidaceae

Platanthera dilatata Lindl. var. leucostachys (Lindl.) Luer.

Platanthera sparsiflora (S. Wats.) Schltr.

Orobanchaceae

Orobanche fasciculata Nutt. var franciscana Achey.

Orobanche uniflora L. var. minuta (Suksd.) Achey.

Pinaceae

Abies concolor (Gord. & Glend.) Lindl.

Abies magnifica A. Murr. var siastensis Lemmon.

Pinus albicaulis Engelm.

Pinus balfouriana Grev. & Balf. in A. Murr.

Pinus contorta Dougl. ex Loud. ssp. murrayana Critchf.

Pinus jeffreyi Grev. & Balf. in A. Murr.

Pinus monticola Dougl.

Tsuga mertensiana (Bong.) Carr.

Polemoniaceae

Collomia grandiflora Dougl. ex Lindl.

Collomia tinctoria Kell.

Gilia capillaris Kell.

Ipomopsis aggregata (Pursh.) V. Grant.

Leptodactylon pungens (Torr.) Rydb. ssp hookeri (Dougl.) Wherry.

Polemoniaceae (continued)

Microsteris gracilis (Hook.) Greene.Phlox diffusa Benth.Polemonium chartaceum Mason.

Polygonaceae

Eriogonum alpinum Engelm.Eriogonum marifolium T. & G.Eriogonum nudum Dougl. ex Benth. var. nudumEriogonum siskiyouense Small.Eriogonum strictum Benth. ssp. proliferum (T. & G.) S. Stokes.Eriogonum umbellatum Torr. var. argus Reveal ined.Eriogonum umbellatum Torr. var. humistratum Reveal ined.Polygonum bistortoides Pursh.Polygonum davisiae Brew. ex Gray.Polygonum douglasii Greene.Polygonum kelloggii Greene.Polygonum minimum Wats.Polygonum sawatchense Small.Rumex acetosella L.

Portulacaceae

Calytridium umbellatum (Torr.) Greene.Claytonia lanceolata Pursh.Lewisia leana (Porter) Rob. in Gray.Lewisia nevadensis (Gray) Rob. in Gray.Montia perfoliata (Donn.) Howell. var. depressa (Gray) Jeps.

Primulaceae

Dodecatheon alpinum (Gray) Greene. ssp. majus H.J. Thomps.

Pteridaceae

Cheilanthes gracillima D.C. Eat. in Torr.Cryptogramma acrostichoides R. Br. in Richards.

Ranunculaceae

Aconitum columbianum Nutt.Anemone drummondii Wats.Aquilegia formosa Fisch in DC.Caltha howellii (Huth.) Greene.Delphinium glaucum Wats.Delphinium sonnei Greene.Ranunculus alismaefolius Geyer ex Benth. var. alismellus Gray.

Rhamnaceae

Rhamnus californica Esch. ssp. occidentalis (Howell) C.B. Wolf.

Rosaceae

Amelanchier pallida Greene.

Cercocarpus ledifolius Nutt.

Holodiscus microphyllus Rydb. var. glabrescens (Greene) Ley.

Ivesia gordonii (Hook.) T. & G.

Potentilla breweri Wats.

Potentilla fruticosa L.

Potentilla glandulosa Lindl. ssp. nevadensis (Wats.) Reck.

Potentilla gracilis Dougl. ex Hook.

Prunus emarginata (Dougl.) Walp.

Spiraea densiflora Nutt. ex T. & G.

Rubiaceae

Galium aparine L.

Galium bifolium Wats.

Galium glabrescens (Ehrend.) Demp. & Ehrend.

Kelloggia galiodes Torr.

Sarraceniaceae

Darlingtonia californica Torr.

Saxifragaceae

Heuchera merriami Eastw.

Parnassia palustris L. var. californica Gray.

Saxifraga aprica Greene.

Scrophulariaceae

Castilleja applegatei Fern. var. fragilis (Zeitl.) Holmg.

Castilleja arachnoidea Greenm.

Castilleja miniata Dougl. ex Hook.

Castilleja pruinosa Fern.

Collinsia parviflora Dougl. ex Lindl.

Collinsia rattanii Gray.

Collinsia torreyi Gray. var. wrightii (Wats.) Jth.

Mimulus breweri (Greene) Coville.

Mimulus guttatus Fisch. ex DC.

Mimulus moschatus Dougl. ex Lindl.

Mimulus nanus H. & A.

Scrophulariaceae (continued)

Mimulus primuloides Benth.Mimulus primuloides Benth. ssp. linearifolius (Grant) MunzMimulus tilingii Regel.Orthocarpus copelandii Eastw.Pedicularis attolens Gray.Pedicularis racemosa Dougl. ex Hook.Penstemon davidsonii Greene.Penstemon laetus Gray. ssp. roezlii (Regel) Keck.Penstemon newberryi Gray.Penstemon parvulus (A. Gray) Krauttar.Penstemon procerus Dougl. ex Grah. ssp. formosus (A. Nels.) Keck.Veronica copelandii Eastw.Veronica serpyllifolia L. var. humifusa (Dickson) Vahl.

Umbelliferae

Angelica arguta Nutt. ex T. & G.Ligusticum grayi Coult. & Rose.Lomatium Engelmännii Math.Lomatium macrocarpum (H. & A.) Coult. & Rose.Osmorhiza chilensis H. & A.Osmorhiza occidentalis (Nutt.) Torr.Perideridia parishii (Coult. & Rose) Nels. & Macbr.ssp. latifolia (A. Gray) Chuang & Constance.Sanicula graveolens Poepp. ex DC.Sanicula tuberosa Torr.

Valerianaceae

Valeriana capitata Pall. ex Link. ssp. californica
(Heller) F.G. May.

Violaceae

Viola adunca Sm.Viola macloskeyi Lloyd.Viola purpurea Kell.